Research and Development
Project Approval Request

1. Identification

This project is the follow-on to the Drell Committee, and will carry out development of procedures for image quality evaluation on aerial photography. Its internal designation is, "Image Quality Evaluation Program." The project will come under the Technical Development program of the P&DS, NPIC, at a total estimated cost of [redacted]. It will involve contractual obligations to five industrial firms, and to the National Bureau of Standards. It was not originally included in NPIC's 1964 financial plans, and funds are not available without deferring other projects scheduled for this fiscal year. 25X1A

2. Objectives

The program will develop and validate a procedure(s) for both technical and routine analysis for determining the quality of aerial photography, applying microdensitometric edge-trace (or any other analytical technique of equal or improved precision which may or may not involve edges) and comparative photography, designated as [redacted] The method and procedures must be suitable for routine production, using automated techniques, but expediency must not be substituted for accuracy. 25X1A

3. Background 25X1A

The report from the [redacted] Committee established the need for examination of operational photography through the technique of edge-trace and [redacted] to assess quality (through derived knowledge of the system transfer function), and provide guidance for analysis of system errors. Following this report, a memorandum was issued by Mr. Lundahl outlining a plan for implementation of this by NPIC. Subsequently, a committee convened at the instigation of NRO and published a memorandum outlining four (4) basic tasks, of which the Image Quality Evaluation was one. A work statement was issued, outlining the aims of the study, and suggesting a committee consisting of industrial and governmental organizations be formed to do the necessary work. This project approval request is based on that work statement. All the institutions listed in the work statement have been contacted, and proposals received in reply. 25X1A 25X1A

The program will be a direct extension of the [redacted] Committee recommendations, with an allowance made for additional considerations in pursuit of the same goal. The efforts of the group will be focused at NPIC..

Some investigation and development are already underway by the Plans and Development Staff, and these will supplement the work to be carried out by the committee. The group is made up of representatives of industrial and governmental organizations actively engaged in image quality evaluation techniques and data reduction. A nine to twelve month effort by this group of expert talent will define an experimental program and send out tasks (contracts as required) to competent laboratories (NPIC, SPPL, BuStandards, FTD, etc.) and specific contractor laboratories to complete the experimental program outlined.

The group plans to meet regularly to plan the technical developments and review the results. The experimental program will be periodically revised to reject as quickly as possible those methods of limited promise, and to arrive expeditiously at standard procedures.

4. Technical Specifications

The group membership is as follows:

Chairman: [redacted] 25X1A
Vice-Chairman:
Technical Advisor: [redacted] STATOTHR
Members: [redacted] STATOTHR

STATOTHR [redacted], Perkin-Elmer Corp.
Itek Corporation
Eastman Kodak Company (Representative as yet unassigned)

25X1A [redacted] NRO STATINTL !

The individual members of this group have all submitted proposals for undertaking various aspects of the work. In general, there is sufficient overlap of those important areas where some duplication is mandatory for scientific accuracy. All of the relevant areas of the problem have been covered. The group will initially meet at NPIC, learn of each other's program, establish a common program philosophy, and establish working procedures. This initial meeting will be based on the following preliminary outline:

a. Conduct a review of work carried out to date, both published and unpublished.

b. Survey and analyze the characteristics of microdensitometrics available to group members and organizations, tasked by the group as well as other commercially available instruments suitable for edge measurements.

c. Review other quantitative and qualitative measures of image quality to be investigated.

d. Recommend the laboratory and/or organization and define the work to be accomplished there in support of the objectives.

Following this initial meeting, the program will be carried out at the contractors' facilities. Meetings will be held subsequently as required for review, re-orientation, and program evaluation. The remainder of the program will be carried out according to the following outline, approximately.

Investigation and Experiment:

a. Specify and prepare sample edges, comparators, or other materials for circulation and/or assignment to specific organizations. These materials to be prepared by a calibrated image forming system with known transfer function. Emphasis to be placed on 4404 film, but a second film (4400) should be included for comparison.

b. Procedures, measurements and data reduction resulting from the supplied materials of each laboratory and/or organization is to be provided all the other laboratories and/or organizations.

c. Group review so as to make modifications of techniques and repeat the experiment. This procedure to be continued until a concensus is achieved on proper procedure

d. Evaluation of results must at all times be guided by appropriate statistical measures of systematic and random errors.

e. Techniques should be recorded and rejected that are not susceptible to application by trained technicians in a routine way.

Evaluation:

a. Apply the approved techniques to actual aerial photographs.

b. Analyze these results statistically to determine the accuracy and reliability under different conditions.

c. Publish procedures that apply to collection systems and that can be used by trained technicians.

5. Contractor and Financial Arrangement

Various aspects of this program will be placed with the contractors listed below, for the amounts shown. The program will cover 9-12 months.

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Each of these firms has been chosen because of its prominance in the field of Image Quality Evaluation. All but the [redacted] and the National Bureau of Standards were on the [redacted] Committee, and therefore are fully cognizant of all the problems involved. This project constitutes an investigation into ill defined and unexplored realms of knowledge for which the work to be performed cannot be precisely defined. Therefore, it is proposed that this work be negotiated on a cost plus fixed fee basis.

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6. Coordination

This program has been worked out in cooperation with NRO and is known (and approved by) the DD/S&T. All results will naturally be made available to these components.

7. Security

It is planned to operate this group on an unclassified basis, except for one member of each institution who will be fully cleared for access to all relevent data and material at NPIC. SC-1, Confidential, should suffice for all contractual arrangements.

29 April 1963

MEMORANDUM FOR: Assistant for Plans and Development

THROUGH : Executive Secretary, TDC

SUBJECT : Staff Study - Image Enhancement Viewer Phase II

1. PROBLEM:

Additional mechanical modifications are necessary to allow this instrument to operate without vibration and to allow accurate placement of component parts along the viewer bed. Simplicity of control is contemplated in a movable control panel. There is a need for continued evaluation of this type of instrument to thoroughly investigate its possible use for classified film capabilities in photointerpretation.

2. DISCUSSION

Phase I of this contract produced desirable results as far as the types of filters to be used, light source development, and filtering concepts leading to image edge enhancement. Phase II of this contract will enable NPIC to obtain an operational instrument with those modifications indicated in item 1. To date there has been no possibility of using classified film for edge enhancement. After "in-house" availability is realized, evaluation should be made which would determine accuracy of measurements attainable at image scale of the viewer and also to determine the possibility for accentuating low contrast image edges. At present, the Image Enhancement Viewer will produce, through the use of spatial filtering techniques, a photographic transparency having certain frequencies eliminated above and/or below preset levels which are dependent upon the size of filter and aperture used. The end result therefore, is image edge enhancement.

3. CONCLUSION:

The instrument in its present phase of development is operational but modifications should be made as are incorporated in Phase II of the contract extension to improve stability and ease of operation.

ACTION RECOMMENDED:

In order that the study be brought to a satisfactory conclusion at the Itek Laboratories and that subsequent analysis be made of additional photography of a classified nature at NPIC, it is recommended that the requested contract, "Extension of Spatial Filtering Development for Image Enhancement Viewer (T.O. No. 4, Contract EB-425) be approved. The contract extension, referred to as Phase II will be complete within six months from date of award and shipment to the Center will take place subsequent to this period at a total cost of $49,186.

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[redacted]

Development Branch, PSDS